MINERALS COUNCIL OF AUSTRALIA

SUBMISSION TO THE SENATE INQUIRY INTO THE IMPACT OF MINING OPERATIONS ON THE ENVIRONMENTAL VALUES OF THE MURRAY-DARLING BASIN

13 OCTOBER 2009

EXECUTIVE SUMMARY

Members of the Minerals Council of Australia (MCA), representing over 85% of minerals production in Australia, have a long-standing commitment to sustainable development including the responsible stewardship of natural resources. Minerals operations contribute significantly to Australia's economic prosperity, including:

- 8% national GDP;
- 42% of goods and services exports; and
- tax and royalties in 2007/8 of $13.04 billion and in 2008/9 of $21.019 billion.

This economic contribution is delivered from a limited natural resources base, including a landscape footprint of just 0.3% and a water usage of 3% of national consumptive use. Much of the water used by minerals operations is not fit for other purposes (e.g. being hyper-saline) and is recycled internally to minimise freshwater input requirements.

Mining in the Murray-Darling Basin accounts for approximately 5% of total national minerals production. The Basin accounts for just over 8% of total minerals industry employees, approximately 10,000 employees. Currently 35 minerals operations are in the Basin, with few projected significant developments beyond pre-feasibility stage.

Environmental Values in the Murray-Darling Basin

This Senate inquiry is examining the impact of mining operations on environmental values in the Murray-Darling Basin. The Murray-Darling Basin Authority (MDBA) identifies the following key values and functions of the Basin:

- high environmental value assets (biodiversity, recreational, amenity);
- water supply and distribution (human water consumption, irrigation, navigation); and
- agricultural production (irrigated agriculture).

According to the MDBA, continued agricultural productivity in the Basin is linked to arable land availability, soil conservation, and water availability and reliability. Protection of environmental assets is related to water availability, seasonality and quality; ecosystem integrity and continuity; controlling pollutants loads; soils conservation; and riparian zone stability.

Impacts of Mining on Environmental Values in the Murray-Darling Basin

There is a long history of mining in the Basin, with regionally significant gold, copper and coal mining operations. However, the footprint of minerals operations in the Basin is very small, approximately 2 800 km^2 (0.26% of the Murray Darling Basin Commission's[1], estimate of the Murray-Darling Basin area of 1 061 469 km^2). Water consumption by mining in the MDB represents less than 0.5% of total water consumption (ABS[2], 2008).

Evidence regarding system-wide impacts from mining operations on either environmental or agricultural values across the Murray-Darling Basin is scant. For example, CSIRO recently considered the minerals industry's water use in the Basin so insignificant that it was not included as a 'use' in the Sustainable Yields assessments for the Basin.

Conversely, there is ample evidence highlighting broad-scale processes that are detrimental to agricultural productivity and environmental values in the Basin. The key processes driving these changes include dryland salinity, environmental water buybacks, and urban expansion. Minerals operations have barely been mentioned by scientists, policy makers and stakeholders charged with resolving the natural resource management challenges of the Murray-Darling Basin.

Regulation of Mining Activity in the Murray-Darling Basin the Basin

Notwithstanding the relatively low importance of minerals operations in influencing Basin-wide processes, there are currently more than 35 pieces of legislation that control minerals operations' use of land and water resources within the Murray-

1 Murray Darling Basin Commission (2006). Basin Statistics. Information available on the Internet from: http://www.mdbc.gov.au/about/basin_statistics last updated 29/10/2006. Last accessed 07/09/2009.

2 ABS (August 2008). Water and the Murray-Darling Basin - A Statistical Profile, 2000-01 to 2005-06. Chapter 3 – Water Use. ABS Catalogue No. 4610.0.55.007 (p. 59 Table 3.7)

Darling Basin. Localised impacts from minerals operations are comprehensively assessed before development can occur, and actual impacts are monitored and reported annually, in accordance with project approval and other regulatory requirements.

Benefits of Mining in the Murray-Darling Basin

With this low natural resources footprint, and tight regulatory requirements, the minerals industry provides significant benefits to regional communities including:

- diversification of regional economies (including the opportunity for holders of water entitlements to sell temporary allocations to high-value users);
- thickening of water markets, enabling water to flow to its highest value use (see the NWC's most recent Water Markets Report, where average prices for water were highest in the Hunter Valley);
- benefit sharing with, and economic opportunities for, Indigenous community stakeholders (e.g. the Wiradjuri Condobolin Corporation);
- enhanced knowledge and capacity building around natural resource management[3] (see the Lake Cowal Foundation, and sgricultural research undertaken at the Northparkes mine for two examples); and
- opportunities to support structured and planned land use change to bring development opportunities back into alignment with natural resources capability.

If the maximum potential of these benefits is to be realised, and the current values of the Basin are to be protected, an integrated land use planning program is required.

The apparent tensions between agriculture and mining , despite their public profile and claims to the contrary, should not be considered as compromising food security, the Murray-Darling Basin water resources, nor agricultural productivity, rather are a manifestation of the uncertainty of the consequence of multiple and sequential land use planning or the inadequacy thereof.

Structured and integrated land use planning initiatives can help resolve these tensions, by having open and transparent discussions around land use values and opportunities, understanding all stakeholders' perspectives, and fostering an understanding of the conditions under which development can occur.

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[3] The *2001 State of Environment* report highlights[3]:
"*The mining industry, for example, employs biologists to study and evaluate biological values in many parts of Australia, for the purpose of codes and environmental impact assessments associated with proposed developments. Previously only biologists from government departments and academic institutions collected the regional biological datasets."* (pp. 71-72)

1. INTRODUCTION AND BACKGROUND

1.1 Senate Committee Terms of Reference and MCA's Submission Outline

On 12 August 2009 the Senate referred the following matters to the Senate Standing Committee on Environment, Communications and the Arts for Inquiry and Report.

- the potential impacts of current and projected mining operations on all environmental values in the Murray-Darling Basin and, in particular, the potential impacts upon surficial and groundwater flows and quality in the alluvial flood plains at its headwaters in the Namoi Valley and the Darling Downs catchments; and
- evaluation of the potential impacts in the context of the Murray-Darling Plan and agricultural productivity.

The MCA submission is framed to address these lines of inquiry by reviewing, documenting and synthesising evidence that considers:

- an overview of the minerals industry in Australia, including land and water use;
- environmental values of the Murray-Darling Basin;
- the extent of current and potential operations in the Murray-Darling Basin and their use of natural resources;
- impacts of minerals operations on environmental values in the Basin;
- local-scale impacts of minerals operations and their management; and
- drivers of agricultural productivity in the Murray-Darling Basin and the relative importance of minerals operations.

1.2 The Australian Minerals Industry

Members of the Minerals Council of Australia (MCA), representing over 85% of minerals production in Australia, are committed to sustainable development, including the responsible stewardship of natural resources (see www.minerals.org.au for a complete list of MCA members).

Whilst only impacting on 0.3% of the Australian landscape, and using less than 3% of water resources, minerals operations contribute:

- 8% national GDP (Australian Bureau of Statistics, National Accounts 5206, and Mining Indicators, 8417, MCA calculations)
- 42% of goods and services exports (ABS International Trade in Goods and Services 5368, ABARE Commodity Statistics, September Quarter 2008); and
- tax and royalties in 2007/8 of $13.04 billion and in 2008/9 of $21.019 billion (Access Economics, Tax Contribution of the minerals industry).

Most minerals operations are in regional and remote Australia, where the minerals industry is a significant manager of environmental values local to their operations. Traditionally, the investment that mining operations made in environmental management was mandated by regulatory authorities through the impact assessment process. However, many minerals operations now recognise that initiatives to better-manage their natural resource assets, beyond duty of care requirements, reflect on their 'social license to operate'. Accordingly there has been an increasing effort by minerals companies to invest in landscape and water resource management far-beyond mandated requirements.

In this submission, the MCA does not seek a diminution of measures to protect the environment, but rather promotes improvements to the efficiency and co-ordination of legislation and policy instruments within and between jurisdictions.

The MCA strongly advocates the principle of minimum effective regulation – that the development of good regulatory process should be informed by the following principles:

- regulatory approaches should not be used unless a clear case for action exists, including an evaluation of why existing measures are not sufficient to deal with the issue;

- a range of policy options (including self-regulatory and co-regulatory approaches) have been assessed and found wanting;
- the regulation represents the greatest net benefit to the community;
- the regulation developed is the most efficient means of achieving the desired outcome at least cost to industry;
- effective guidance is provided for both regulators and stakeholders to ensure that the regulations are correctly implemented and monitored;
- mechanisms such as sunset clauses or periodic reviews are built into the legislation to ensure that the regulations remain relevant over time; and
- there is effective consultation with stakeholders at key stages of the development and implementation of the regulation.

The MCA accordingly supports the COAG commitments to reduce regulatory overlap and burden[4], and the Commonwealth commitments to implementing best-practice regulatory approaches[5], whilst maintaining environmental integrity.

In line with industry's commitment to sustainable development, the MCA developed *Enduring Value – The Australian Minerals Industry Framework for Sustainable Development.* Developed with the input of over 900 stakeholders, *Enduring Value* contains a series of principles, elements and implementation guidance that provides a framework for the integration of environmental, social and economic considerations into mining and minerals processing at the site level. Commitment to *Enduring Value*, including public reporting of implementation, is a condition of membership to the MCA. Companies that are signatories to *Enduring Value*, are required in their operations in Australia to, amongst other things:

- seek continual improvement [in] environmental performance [including]:
    - assess the positive and negative, the direct and indirect, and the cumulative environmental impacts of new projects – from exploration through closure.
    - implement an environmental management system focused on continual improvement to review, prevent, mitigate or ameliorate adverse environmental impacts.
    - rehabilitate land disturbed or occupied by operations in accordance with appropriate post-mining land uses.
- contribute to conservation of biodiversity and integrated approaches to land use planning [including]:
    - respect legally designated protected areas.
    - disseminate scientific data on and promote practices and experiences in biodiversity assessment and management.
    - support the development and implementation of scientifically sound, inclusive and transparent procedures for integrated approaches to land use planning, biodiversity, conservation and mining.

1.3 Land Use Policy and Practice

Although *Enduring Value* was only established in 2005, there are several excellent examples of how minerals operations are implementing this continuous improvement framework. The MCA's land use policy advocates principles that are implemented throughout the minerals operation lifecycle (see *Enduring Value* and MCA Land Use Policy for more information).

To support operational implementation of these policies and principles, the industry has worked collaboratively with the Commonwealth Department of Resources, Energy and Tourism (and previously the Federal Environment Department) to provide nationally consistent guidance to support the protection and management of natural resources through mining operations. The 'Leading Practice Sustainable Development' program has helped 'mainstream' natural resource

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[4] COAG Principles of Best Practice Regulation http://www.finance.gov.au/obpr/proposal/coag-requirements.html
[5] http://www.finance.gov.au/obpr/about/

management, and certainly further integrate its consideration into mining industry practices, through a series of handbooks which provide leading practice guidance to operations. Those handbooks which are relevant to this inquiry include:

- 'Biodiversity Management' (2007);
- 'Water Management' (2008);
- 'Working with Indigenous Communities' (2007);
- 'Mine Rehabilitation' (2006); and
- 'Mine Closure and Completion' (2006).

1.4 Water Use

At the last national account (ABS 2004-2005; Table 1), the minerals sector was responsible for 2.4% of Australia's net water consumption, and was one of the highest-value users of that water. In the capital-intensive minerals industry, water is a critical business input for almost all operations, being used in a variety of ways, especially dewatering of ore bodies and processing to capture ores from other material. In almost all cases mining and minerals processing cannot occur without secure access to reliable water supplies.

Table 1 Industry Gross Value Added (IGVA) figures quantified by water use volumes (ABS data for 2004-2005)

	IGVA ($m)	Water Cons. (GL)	IGVA (%)	Water Use (%)	IGVA/Vol ($m/GL)
Agriculture	$24,344	12,191	3	73	$2.00
Forestry and fishing	$2,347	51	0	0	$46.02
Mining	$64,223	413	8	2	$155.50
Manufacturing	$99,688	589	13	4	$169.25
Water supply	$7,407	2,083	1	13	$3.56
Electricity and gas	$14,444	271	2	2	$53.30
Other industries	$577,333	1,059	73	6	$545.17
Total	$789,786	16,657			

The relative volume and quality of water used by the industry varies widely across Australia. In some regions, especially outside of the Murray-Darling Basin, the minerals industry can account for up to 73% of consumptive use (ABS 2006).

Much of the water used by the minerals industry is not fit for purposes other than industrial applications, and often mining companies invest significantly in infrastructure to deliver water. For example, in the Western Australia goldfields, minerals companies have invested significantly in minerals processing technologies to adapt them to enable the use of hyper-saline groundwater to chemically extract gold from ore.

Lack of water resource security can threaten the viability of existing mining operations and potential new developments. For example, in 2007, the continuance of Cadia Valley Operations in the Murray-Darling Basin, was threatened due to a scarcity of water, with the livelihoods of 400 local employees in a regional town at risk (Orange City Council 2007).

The MCA has been a strong supporter of the water reform process, and shares the vision of the National Water Initiative. As a high-value user of water, the industry is heavily regulated, and the intersection of those regulatory frameworks and the water reform process is yet to be appropriately recognised, understood and reconciled by Governments.

2. THE ENVIRONMENTAL VALUES OF THE MURRAY-DARLING BASIN

The Murray-Darling Basin Authority identifies the following key values and functions of the Basin:

- high environmental value assets (biodiversity, recreational, amenity);
- water supply and distribution (human water consumption, irrigation, navigation); and
- agricultural production (irrigated agriculture).

2.1 High Environmental Value Assets

General

The three longest rivers in Australia all run through the Murray-Darling Basin. These are:

- the Darling River (2 740 km)
- the River Murray (2 530 km); and
- the Murrumbidgee River (1 575 km).

The Basin has at least 35 endangered species of birds, 16 species of endangered mammals and over 35 native fish species. Many of the native plants and animals are protected in national parks and other reserves which comprise about 7% of the Basin's total area. The Basin has over 30 000 wetlands, some of them listed internationally for their importance to migratory birds who visit the sites and many others within the Basin from other parts of Australia and overseas.

The MDBA has identified six icon sites that are a focus of the Living Murray Initiative (MDBA, 2009[6]). The icon sites, chosen for their high ecological, cultural, recreational, heritage and economic value, are:

- Barmah–Millewa Forest;
- Gunbower–Koondrook–Perricoota Forest;
- Hattah Lakes;
- Chowilla Floodplain and Lindsay–Wallpolla Islands;
- Lower Lakes, Coorong and Murray Mouth; and
- River Murray Channel.

[6] MDBA, http://www.mdba.gov.au/programs/tlm last accessed 01/09/2009

The CSIRO, as part of the Sustainable Yields Project, also prepared a list of key environmental assets in the Murray-Darling Basin (see Table 2).

Table 2 Environmental assets as identified by CSIRO (2008[7])

Catchment	Environmental asset
Wimmera	"Lake Hindmarsh", "Lake Albacutya"
Loddon	"Loddon May to October habitat maintenance", "Loddon Freshes and over bank flows"
Campaspe	"Campaspe summer low flows", "Campaspe winter high flows"
Goulburn	"Lower Goulburn River wetlands", "Lower Goulburn River pool habitat"
Ovens	"Ovens River Channel high flow"
Murray	"Barmah-Millewa Forest", "Gunbower, Koondrook-Perricoota Forest", "Hattah Lakes", "Chowilla-Lindsay-Wallpolla", "Lower Lakes, Coorong and Murray mouth", "Great Darling Anabranch Lakes/wetlands"
Murrumbidgee	"Mid-Murrumbidgee Billabongs and wetlands", "Lowbidgee Wetlands"
Lachlan	"Booligal wetlands", "Great Cumbung Swamp"
Barwon Darling	"Talyawalka wetlands", "Bourke weir drown out for fish passage", "Min flow for algal growth"
Macquarie-Castlereagh	"Macquarie Marshes"
Namoi	"Namoi River channel"
Gwydir	"Gwydir Wetlands"
Border Rivers	"Border Rivers channel and anabranches"
Moonie	"Moonie river channel"
Condamine Balonne	"Back and Clear Lakes", "Narran Lake", "lower Balonne wetlands"
Warrego	"Yantabulla swamp", "Warrego River water holes"
Paroo	"Paroo Overflow", "Lake Numulla", "Lake Wyara"

[7] CSIRO (2008). Murray-Darling Basins Sustainable Yields Project - Technical Workshop. Monday 15 December 2008, CSIRO Discovery Centre, Black Mountain, Canberra. Environmental Water. p.5. Presentation available on the Internet from: http://www.clw.csiro.au/conferences/MDBSY/Nick%20Marsh%20MDBSY%20Env%20reporting131208.pdf last accessed 08/09/2009.

The NSW Environment Protection Authority developed a list of generic environmental values[8], each of which could be associated with the Murray-Darling Basin. These include:

- aquatic ecosystems – maintaining or improving the ecological condition of waterbodies and their riparian zones over the long term;
- visual amenity – aesthetic qualities of waters;
- primary contact recreation – maintaining or improving water quality for activities such as swimming in which there is a high probability of water being swallowed;
- secondary contact recreation – maintaining or improving water quality for activities such as boating and wading, where there is a low probability of water being swallowed;
- livestock water supply – protecting water quality to maximise the production of healthy livestock;
- irrigation water supply – protecting the quality of waters applied to crops and pasture;
- homestead water supply – protecting water quality for domestic use in homesteads, including drinking, cooking and bathing;
- drinking water at point of supply – groundwater, surficial, disinfection only or clarification and disinfection;
- aquatic foods (to be cooked before eating) – protecting water quality so that it is suitable for the production of aquatic foods for human consumption and aquaculture activities.

An additional consideration is:

- floodplain/Wetland ecosystems functions (flood attenuation, water purification) – Maintaining floodplain and wetland ecosystems hydrological and geomorphologic functionality (Save the Murray, June 2007[9]).

The key factors that are essential to sustaining the environmental values above are:

- water quantity and seasonality;
- water quality (especially salinity);
- ecosystems integrity and continuity;
- controlling pollutants loads;
- soils conservation; and
- bank stability.

Values dependent on groundwater

The groundwater dependent ecosystems of the Murray-Darling Basin are a distinct component of the ecological values of the region and significantly add to the Basin's biodiversity (MDBC, 2005[10]). These ecosystems are unique because of their dependency on at least some ecological processes on groundwater. Many of these ecosystems are poorly understood. Moreover, these systems are facing increasing pressure from consumptive uses of groundwater and land use changes.

The recognised groundwater dependent ecosystems include those listed in Table 3.

[8] Department of Environment and Conservation NSW (May 2006). Considering Environmental Values of Water when Issuing Prevention Notices. Guidelines issued by the Environment Protection Authority to appropriate regulatory authorities under s 96(3A) of the Protection of the Environment Operations Act 1997. Available on the Internet from http://www.environment.nsw.gov.au/resources/mao/envvalueswater06171.pdf last accessed 03/09/2009.

[9] Save the Murray (29.06.2007). Factsheet no.18: Wetlands. p.1. Available on the Internet: http://www.savethemurray.com.au/media/fact_sheet_18_wetlands.pdf last accessed 03/09/2009.

[10] Murray Darling Basin Commission (2005). Murray Darling Basin e-Resources 2005. Chapter 2 Groundwater Resources. Available on the Internet from http://www.mdbc.gov.au/subs/eResource_book/chapter2/p4.htm last accessed 07/09/2009.

Table 3 Groundwater dependent ecosystems (from MDBC, 2005[11])

Ecosystem	Description
Swamp sclerophyll forests and woodlands	These are a widely distributed group of ecosystems that exhibit at least seasonal dependency on groundwater. They include a wide range of eucalypt species that occupy the riparian corridors of ephemeral or baseflow dependent streams, such as the River Redgum (*E. camaldulensis*) and Black Box (*E. largiflorens*) woodlands of the Murray and Darling River floodplain.
Swamp scrubs and heaths	This type of ecosystem normally occupies sandy or peaty soils in landscapes such the swampy areas fed by snow melt in the MDB highlands.
Swamp shrublands	Lignum (*Meuhlenbeckia cunninghamii*) dominated shrublands are common features of the inland ephemeral stream and lake systems of Murray-Darling Basin. Groundwater dependency is suspected but the exact nature of the relationship is unknown
Sedgelands	Many sedgeland communities exist in the floodplain and riparian zones throughout the Murray-Darling Basin. Most require at least seasonal waterlogging and those which require permanent water are almost certainly groundwater dependent (e.g *Eleocharis sphacelate* sedgelands in lagoons of the Murray River and tributaries and *Baumea* sedgelands of the Coorong).
Springs & Wetlands of the GAB	Mound springs and wetlands are present in the northern MDB which are reliant on the natural discharge from the groundwater of the Great Artesian Basin (GAB). These systems have a unique flora and fauna which are entirely dependent upon groundwater.

2.2 Storing and Distributing Water for Human Use

The following information has been sourced from the MDBA website (at 11 September 2009) unless noted otherwise.

The human population in the Basin is more than 2 million residents.

Water availability in the Murray–Darling Basin is subject to large variations, throughout the year, between years and over longer periods. In the last 100 years, life in the Murray–Darling Basin has been transformed by the construction of major water storages on the rivers. The total volume of publicly managed water storage capacity in the Basin is less than 35 000 GL. Of that, the Murray–Darling Basin Authority — with major storages at the Dartmouth Dam, Hume Dam, Lake Victoria, Torrumbarry Weir, the Menindee Lakes and other river regulatory structures — is responsible for about a third. These storages have made it possible to store water during wet periods and release it as needed during summer or in droughts.

As identified by CSIRO[12], the current average surface water resource of the MDB is 23 417 GL/year. Streamflow losses are naturally high across the MDB. In the absence of flow regulation and consumptive water use, only 14,493 GL/year (62 percent of the total surface water resource) would reach Wentworth on the lower reach of the Murray River and only 12 233 GL/year (52% of the total surface water resource) would reach the Murray mouth on average.

The ABS (2008[13]) provides additional information supporting the essential role of the MDB as the prime water resource to support population and economic activity in the Basin.

[11] Murray Darling Basin Commission (2005). Murray Darling Basin e-Resources 2005. Chapter 2 Groundwater Resources. Available on the Internet from http://www.mdbc.gov.au/subs/eResource_book/chapter2/p5.htm last accessed 07/09/2009.
[12] CSIRO (October 2008). Water availability in the Murray-Darling Basin. A report to the Australian Government from the CSIRO Murray-Darling Basin Sustainable Yields Project. CSIRO, Australia. 67pp. (p. 28)
[13] ABS (August 2008). Water and the Murray-Darling Basin - A Statistical Profile, 2000-01 to 2005-06. Chapter 3 – Water Use. ABS Catalogue No. 4610.0.55.007 (pp. 70-73). Information available on the Internet from http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/4610.0.55.0072000-01%20to%202005-06?OpenDocument last accessed 03/09/2009.

Table 4 Household water consumption 2004-2005 (ABS, 2008)

	Water consumption		MDB water consumption as a proportion of…	
	MDB	Total state/Aust.	Total MDB	Total state/Aust.
	GL	*GL*	*%*	*%*
New South Wales	68	573	36	12
Victoria	52	405	28	13
Queensland	26	493	14	5
South Australia	11	144	6	8
Australian Capital Territory	31	31	16	100
Total	**189**	**2,108**	**100**	**9**

Households accounted for only 2% of MDB water consumption in 2004–05. Household water consumption in the MDB (189 GL) accounted for 9% of water consumption by all Australian households in 2004–05. This is consistent with the proportion of total population living in the MDB (10% in 2006).

Table 5 Manufacturing water consumption 2004-2005 (ABS, 2008)

	Water consumption		MDB water consumption as a proportion of…	
	MDB	Total state/Aust.	Total MDB	Total state/Aust.
	GL	*GL*	*%*	*%*
New South Wales	30	126	56	24
Victoria	15	114	28	13
Queensland	5	158	9	3
South Australia	3	55	5	5
Australian Capital Territory	1	1	1	100
Total	**53**	**589**	**100**	**9**

Water is used in manufacturing for a variety of purposes including cooling, cleaning, as a solvent, and as a food or beverage constituent. The types of manufacturing businesses which use the highest volumes of water in the MDB include pulp and paper mills, abattoirs and other food manufacturing, dairy factories and breweries. Water consumption by manufacturing in the MDB was a low proportion of overall MDB water consumption (0.6%) in 2004–05. Compared with Australia, MDB manufacturing water consumption was also relatively minor (9%). Most occurred in the New South Wales (56%) and Victoria (28%) sections of the MDB.

2.3 Agriculture ('Australia's food bowl')

As detailed by the MDBA, the Basin is Australia's most important agricultural area, producing over one-third of Australia's food supply.

According to the MDBA (2008[14]): "The Basin generates 39% of the national income derived from agricultural production. It produces 53% of Australian cereals grown for grain (including 100% of rice), 95% of oranges, and 54% of apples. The Basin supports 28% of the nation's cattle herd, 45% of sheep, and 62% of pigs."

ABS statistics offer a more focussed summary. In Australia, irrigated land is 0.6% of total agricultural land. In the Basin, irrigated land is 2% of agricultural land. The Basin contains 65% of Australia's irrigated agricultural land.

The main crops are pasture for dairy, meat and wool; cereals; rice; grapes; fruit and nuts; and vegetables (ABS 2008[15]):

- 67% of Australia's irrigated pastureland in 2005–06 was within the MDB. In addition, irrigated pasture consumed more water (2,537 GL) than any other irrigated crop in the MDB. Irrigated pasture in the MDB is mainly used for grazing livestock (1,981 GL) and cutting for hay or silage (531 GL);
- 92% of Australia's irrigated cotton-growing area in 2005–06 was in the MDB. In addition, cotton was consistently the crop with the highest water consumption in the MDB from 2000–01 to 2005–06. Cotton water consumption was almost 1,600 GL in 2005–06;
- in 2005–06, all of Australia's rice and the vast majority (88%) of other irrigated cereals were grown in the MDB;
- 58% of Australia's irrigated grape growing area in 2005–06 was in the MDB. Grape growing consumed 515 GL of water in 2005–06;
- in 2005-6 the MDB contained just over half of Australia's irrigated fruit-growing land. Irrigated fruit consumed 413 GL of water in 2005–06; and
- vegetables: in 2005–06, 28% of Australia's irrigated vegetable growing land area was in the MDB. Vegetable growing used less water than all of the major crops and pastures, just 2–3% of all agricultural water consumption between 2000–01 and 2005–06.

Water availability and water use in the Basin is central to the role played by irrigated agriculture as shown in the following table (Table 6).

Table 6 Water consumption by agricultural commodity 2005-2006 (ABS16, 2008)

	MDB	Australia	MDB as a proportion of Australia
	GL	*GL*	*%*
Dairy farming	1 287	1 893	68
Pasture for other livestock	1 284	2 042	63
Rice	1 252	1 253	100
Cereals (excl. rice)	782	894	88
Cotton	1 574	1 735	91

14 MDBA (2008). Information available from the MDBA website: http://www.mdba.gov.au/water/about_basin (last accessed 02/09/2009)
15 ABS (August 2008). Water and the Murray-Darling Basin - A Statistical Profile, 2000-01 to 2005-06. Chapter 3 – Water Use. ABS Catalogue No. 4610.0.55.007 (pp. 70-73). Information available on the Internet from http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/4610.0.55.0072000-01%20to%202005-06?OpenDocument last accessed 03/09/2009.
16 ABS (August 2008). Water use on Australian Farms (cat. no. 4618.0); ABS data available on request, Agricultural Census, 2005–06. Information available on the Internet from http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/4610.0.55.0072000-01%20to%202005-06?OpenDocument last accessed 03/09/2009.

	MDB	Australia	MDB as a proportion of Australia
Grapes	515	633	81
Fruit (excl. grapes)	413	630	66
Vegetables	152	431	35
Other (incl. broadacre, nurseries, etc.)	461	2 178	21
Total Agriculture	**7 720**	**11 689**	**66**

The key factors that are essential to sustaining agricultural activity in the Basin are:

- arable land availability;
- soils conservation; and
- water availability and reliability.

2.4 Summary of Environmental Values in the Murray-Darling Basin

There are clearly rich and diverse environmental values in the Murray-Darling Basin. The protection of these values is linked to:

- for agricultural activity:
    - arable land availability;
    - soils conservation; and
    - water availability and reliability.
- for high value environmental assets:
    - water quantity and seasonality;
    - water quality (especially salinity);
    - ecosystems integrity and continuity;
    - controlling pollutants loads;
    - soils conservation; and
    - bank stability.

3. MINERALS OPERATIONS IN THE BASIN

3.1 Number of Operations

Currently 35 major minerals operations[17] are active in the Murray-Darling Basin (Figure 1; Geoscience Australia 'Operational Mines' September 2009).

Figure 1 Current minerals operations in the Murray-Darling Basin

[17] This excludes exploration, oil and gas projects and road-base and sand quarrying operations.

3.2 Future Operations

Modern exploration, which is increasingly using remote sensing from satellites or aircraft, is able to proceed to surface phases with no land disturbance. The early stages of a surface exploration program involve activities such as mapping, geophysical measurements and geochemical sampling of stream sediments which are likely to have relatively little effect upon the environment. Follow-up investigations that would require other techniques and that may have some localised and temporary effects may include (see ABARE, AGSO and BRS 1993).

- rock chip sampling;
- collecting soil samples; and
- electrical, gravity, magnetic, seismic or radiometric ground surveys

If the results of this work were positive, additional follow-up work may include drilling.

However, it should be noted that not all exploration results in drilling. The exploration process starts with assessments of very large regions and is then systematically narrowed down as the exploration target becomes better defined. Only a very small proportion of areas covered by exploration leases are ever mined, with development rate in Australia roughly of the order of one mine for one thousand exploration programs (NSW Government and Commonwealth Government 1999).

Although there may be many exploration leases currently granted by State Governments, there are currently few projects[18] in an advanced stage of development within the Basin (Figure 2).

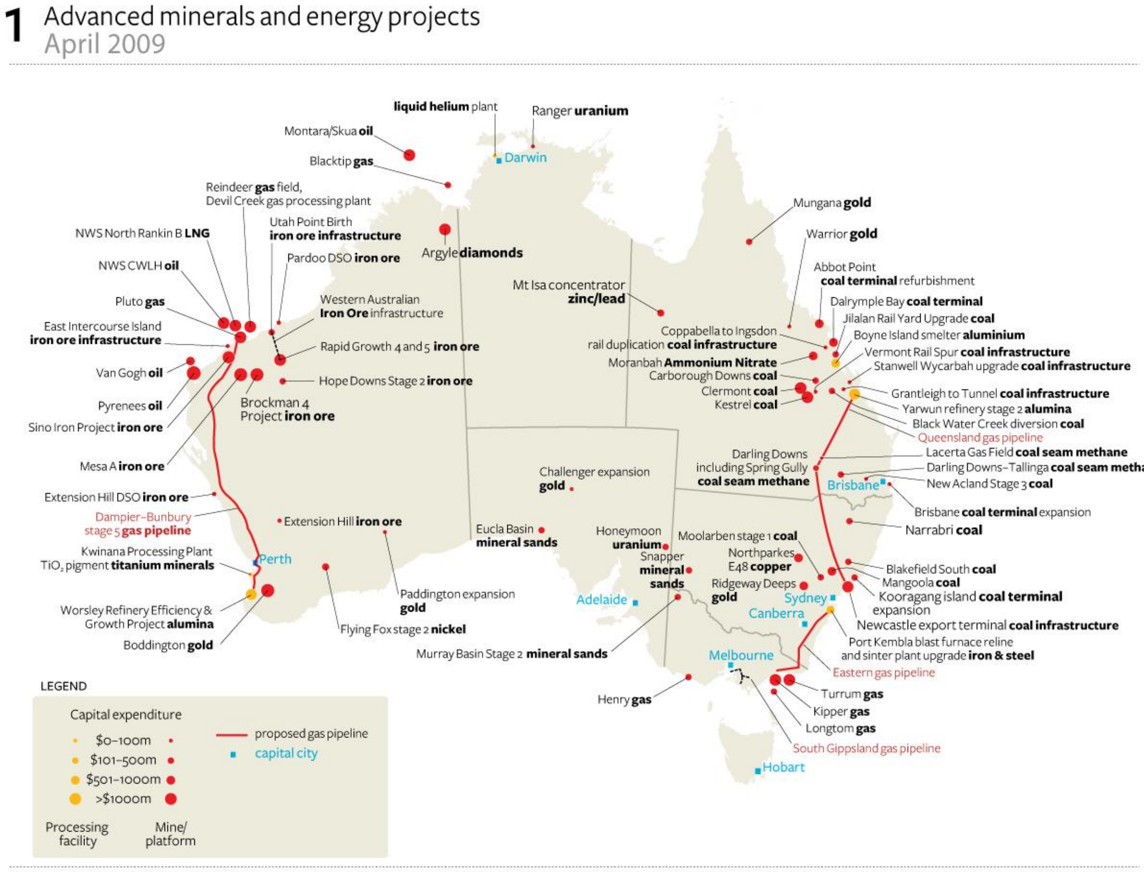

Figure 2 Advanced minerals projects across Australia, highlighting the relatively low number in the Murray-Darling Basin (ABARE 2009)

[18] http://www.abareconomics.com/interactive/09_Listings/pL09_APR/

3.3 Footprint in the Landscape

Assuming an 'average footprint' for each of the operations is 0.26 % of the landscape (based on the national average from the mid-2008 Bureau of Rural Sciences' compilation of ACLUMP [Australian Collaborative Land Use Mapping Programme] Catchment Scale Land Use data), the footprint of minerals operations in the Basin is approximately 2 800 km^2 (0.26% of the Murray Darling Basin Commission's[19], estimate of the Murray-Darling Basin area of 1 061 469 km^2).

For comparative purposes, a single agricultural enterprise, the iconic Cubbie Station, comprises an area of 930 km^2 (Cubbie Group, 2005[20]).

3.4 Water Use

As outlined, at the last national account (ABS 2004-2005; Table 1), the minerals sector was responsible for 2.4% of Australia's net water consumption, and was one of the highest-value users of that water. Water is a critical business input for almost all mining operations, being used in a variety of ways, especially dewatering of ore bodies and processing to capture ores from other material.

Despite the need for water, and number of minerals operations in the Basin, the total use by the industry is not significant. For example, in focussing on the Murray-Darling Basin, CSIRO considered the minerals industry's water use so insignificant that it was not included as a 'use' in the Sustainable Yields assessments for the Basin.

Murray-Darling Basin water balance

Mining operations and their associated water use is increasingly competing with other consumptive water uses. Water is important for mining operations to facilitate the transport, flotation, grinding and separation of minerals, as well as dust suppression. Based on all available empirical evidence, water consumption by mining in the MDB represents a small proportion of MDB water consumption (0.2%) in 2004–05 (ABS[21], 2008).

Surface water resources

In the Murray Darling Basin, most surface water resources have been over allocated. The National Land and Water Resources Audit summarised water over allocation (see Figure 3). Reducing the amount of water extracted from surface water resources is therefore essential to the long term sustainability of the surface water systems in the MDB.

A more detailed investigation into the more specific use of water per surface water management area (SWMA) reveals that even if mining operations tend to be concentrated in specific areas, the impact on the local water balance may be considered as 'low' (NWC, 2005[22]; see Table 7 following Figure 3).

By considering Table 1 and Table 7 together, it is clear that considerable potential for reduction in surface water consumption lies in the development of efficient market mechanisms that will enable the flow of water to higher value uses. Minerals extraction can support economic growth for regional communities with a lower overall water use footprint than lower value uses.

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[19] Murray Darling Basin Commission (2006). Basin Statistics. Information available on the Internet from: http://www.mdbc.gov.au/about/basin_statistics last updated 29/10/2006. Last accessed 07/09/2009.
[20] Cubbie Group (2005). Information available on the Internet from http://www.cubbie.com.au/index.php?option=com_content&task=view&id=26&Itemid=61 last accessed 08/09/2009.
[21] ABS (August 2008). Water and the Murray-Darling Basin - A Statistical Profile, 2000-01 to 2005-06. Chapter 3 – Water Use. ABS Catalogue No. 4610.0.55.007 (p. 59 Table 3.7)
[22] National Water Commission (2005). Australian Water Resources 2005. Data source: Experimental Estimates of Regional Water Use, Australia 2004-05 (ABS Cat. No. 4610.0.55.002). Information available from the Internet from http://www.water.gov.au/WaterUse/Estimatedwateruseinselectedgeographicareas/index.aspx?Menu=Level1_4_5 last accessed 03/09/2009.

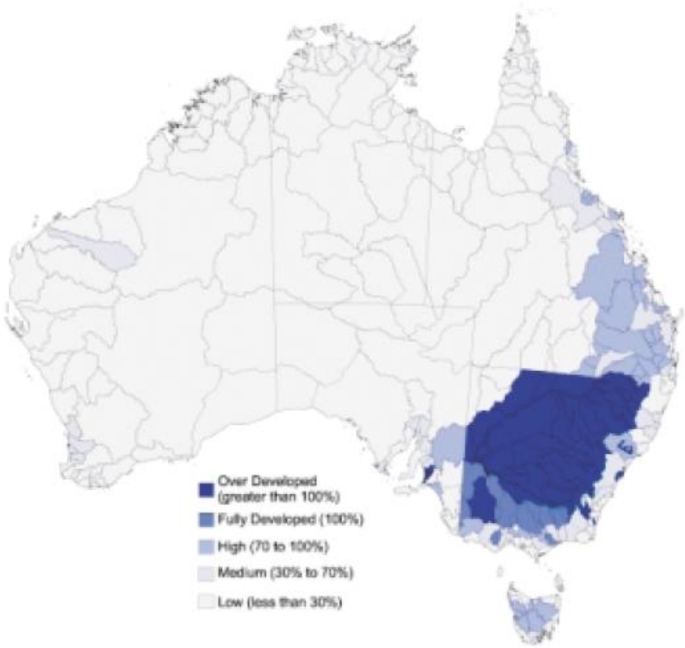

Figure 3 Surface water development status 2000 (NLWRA, 2001 cited in DEWHA, State of the Environment 2001[23])

[23] Australian State of the Environment Committee, 2001. Australia State of the Environment 2001, Independent Report to the Commonwealth Minister for the Environment and Heritage, CSIRO Publishing on behalf of the Department of the Environment and Heritage, Canberra.

Table 7 Impact of mining in major Surface Water Management Areas of the Murray Darling Basin (NWC, 2005)

Surface water management area (SWMA) name and area detail	Water consumption (GL)	Detail
Murrumbidgee River (regulated)(NSW)	1,820	• Agriculture: 84% of total water consumption • Other: 16% of total water consumption • **Mining, manufacturing and households: <1%**
Broken River, Goulburn River, and Campaspe River SWMAs (VIC)	1,362	• Agriculture: 67% of total water consumption • Other: 31% of total water consumption • Household: 2% of total water consumption • **Mining and manufacturing: <1%**
Murray River SWMA (VIC)	1,253	• Agriculture: 96% of total water consumption • Other: 3% of total water consumption • **Mining, manufacturing and households: 1%**
Border Rivers, Condamine Balonne, and Moonie SWMAs (QLD)	1,122	• Agriculture: 89% of total water consumption • Other: 8% of total water consumption • Household: 2% of total water consumption • **Mining and manufacturing: 1%**
Murray (regulated) (NSW)	1,047	• Agriculture: 80% of total water consumption • Other: 19% of total water consumption • Manufacturing: 1% of total water consumption • **Mining and households: <1%**
Melbourne urban Bunyip River, Yarra River, Maribyrnong River, Werribee River, and Moorabool River SWMAs (VIC)	676	• Household: 45% of total water consumption • Other: 35% of total water consumption • Agriculture: 10% of total water consumption • **Mining and manufacturing: <1%**
Loddon River (VIC)	598	• Agriculture: 68% of total water consumption • Other: 30% of total water consumption • Household: 2% of total water consumption • **Mining and manufacturing: <1%**
SA Regional Mallee PWA, Tintinara-Coonalpyn PWA, Peake-Roby-Sherlock PWA, Noora, Murraylands, Coorong, Mallee, and River Murray PWC SWMAs (SA)	453	• Agriculture: 94% of total water consumption • Other: 4% of total water consumption • Household: 1% of total water consumption • **Mining and manufacturing: <1%**
Namoi Namoi River (regulated), and Namoi River (unregulated) SWMAs (NSW)	448	• Agriculture 96% of total water consumption • Other: 2% of total water consumption • **Mining, manufacturing and household: <2%**
Northern NSW Rivers Border Rivers (unregulated), Border Rivers (regulated), Gwydir River (unregulated), and Gwydir River (regulated) SWMAs (NSW)	428	• Agriculture: 97% of total water consumption • Household: 1% of total water consumption • **Mining, manufacturing and other: <2%**
Lower Limestone Coast PWA (SA)	335	• Agriculture: 97% of total water consumption • Household: 1% of total water consumption • Other: 1% of total water consumption • **Mining and manufacturing: 1%**
Macquarie River (regulated), and Macquarie River (unregulated) (NSW)	289	• Agriculture: 86% of total water consumption • Other: 7% of total water consumption • Household: 5% of total water consumption • **Mining and manufacturing: the remainder**

Groundwater resources

There are large resources of groundwater in the MDB (MDBC, 2005[24]) in particular the Great Artesian Basin and the Murray Basin, which are the major groundwater resources of the MDB. However, the resources are unevenly distributed and vary in quality. There are significant variations in terms of abstractions.

While over allocation of surface water is an issue particularly important in NSW and in the south east of Queensland (as shown above), groundwater shows a different trend. Most groundwater resources in the Murray Darling Basin are not fully developed. The major exception is the Great Artesian Basin which, spanning from the farthest north of Queensland to NSW and South Australia is over allocated (Table 8 provides details on the sectors that rely most heavily on water from the GAB). With respect to the Murray Darling Basin, the issue of over allocation of groundwater resources are particularly experienced in the Namoi, Gwydir, Border Rivers, Moonie, Condamine Ballone, Murrumbidgee and Murray catchments. Figure 4 below gives an overview of groundwater development status in 2000.

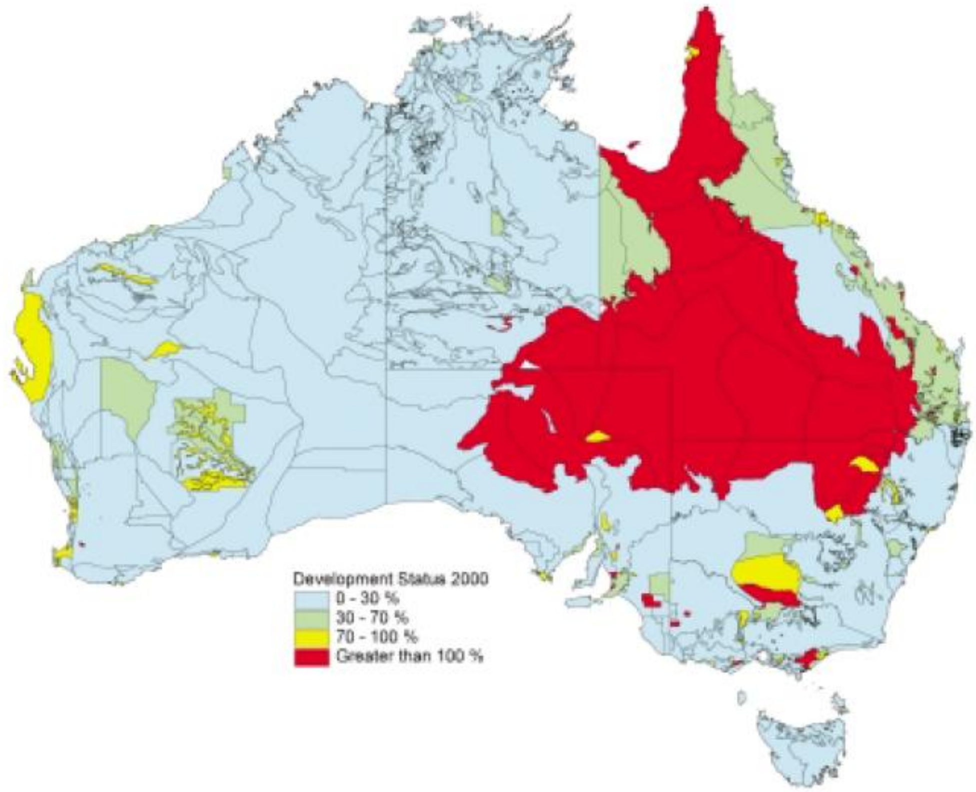

Figure 4 Groundwater development status 2000 (NLWRA, 2001 cited in DEWHA, State of the Environment 2001[25])

[24] Murray Darling Basin Commission (2005). Murray Darling Basin e-Resources 2005. Chapter 2 Groundwater Resources. Available on the Internet from http://www.mdbc.gov.au/subs/eResource_book/chapter2/p4.htm last accessed 07/09/2009.
[25] Australian State of the Environment Committee, 2001. Australia State of the Environment 2001, Independent Report to the Commonwealth Minister for the Environment and Heritage, CSIRO Publishing on behalf of the Department of the Environment and Heritage, Canberra.

Table 8 Groundwater use by industry sector in the Great Artesian Basin (GABCC, 2000[26] p.29)

Industry	Groundwater use (data from 1998)
Pastoral Industries	500 GL *p.a.*
Town Supply	20 GL *p.a.*
Petroleum Industry	20 GL *p.a.*
Irrigation Industry	11 GL *p.a.*
Mining	11 GL *p.a.* (projection to 30 GL *p.a.* by 2002)
Environment	50 GL *p.a.*
Other Industry	6 GL *p.a.*

Although mining is a significant groundwater user group in the GAB based on volume extracted, the access arrangements surrounding that use need to be considered in the context of other users. Not only is the economic value generated from mining's use very high, there are strict regulatory frameworks within which the minerals industry's use is managed.

It is worth noting the following from the GAB Strategic Management Plan (GABCC 2000, p.29), which highlights that a volume of water nearly 10-times the minerals industry's use in the region could be saved through implementing best-practice water management approaches:

> *"500 GL p.a. is extracted by the pastoral industry, with much lost through seepage and evaporation of bore drains. A saving of 200 GL p.a. could be achieved over 15 years."*

The potential savings available through the adoption of leading practice approaches in other industries far outweighs the use of water by minerals operations, either currently or in the foreseeable future.

[26] Great Artesian Basin Consultative Council (2000). Great Artesian Basin Strategic Management Plan. Available on the Internet from http://www.gabcc.org.au/tools/getFile.aspx?tbl=tblContentItem&id=50 last accessed 07/09/2009

4. MINERALS OPERATIONS' IMPACTS ON ENVIRONMENTAL VALUES ACROSS THE BASIN

Empirical evidence regarding impacts of minerals operations on the environmental values of the Basin is scant. Although the years of analysis are different, the order of difference between minerals operations' water use and that afforded agricultural production highlights the relative importance of minerals operations in determining future water access and provisions for both agricultural production and the protection of high-value environmental assets in the Basin (Table 9).

Table 9 Water consumption by agricultural and minerals commodities in the Murray-Darling Basin

	MDB	**Australia**	**MDB as a proportion of Australia**
	GL	*GL*	*%*
Dairy farming	1 287	1 893	68
Pasture for other livestock	1 284	2 042	63
Rice	1 252	1 253	100
Cereals (excl. rice)	782	894	88
Cotton	1 574	1 735	91
Grapes	515	633	81
Fruit (excl. grapes)	413	630	66
Vegetables	152	431	35
Other (incl. broadacre, nurseries, etc.)	461	2 178	21
Total Agriculture[27]	**7 720**	**11 689**	**66**
Total Mining[28]	**20**	**413**	**5**

A review of evidence regarding current natural resource management issues in the Murray-Darling Basin, was undertaken to identify the impacts of minerals operations on the environmental values of the Murray-Darling Basin. For the purposes of this review environmental values assessed included:

- for agricultural activity:
    - arable land availability;
    - soils conservation; and
    - water availability and reliability;
- for high value environmental assets:
    - water quantity and seasonality;
    - water quality (especially salinity);

[27] ABS (August 2008). Water use on Australian Farms (cat. no. 4618.0); ABS data available on request, Agricultural Census, 2005–06. Information available on the Internet from http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/4610.0.55.0072000-01%20to%202005-06?OpenDocument last accessed 03/09/2009.

[28] ABS (August 2008). Water and the Murray-Darling Basin - A Statistical Profile, 2000-01 to 2005-06. Chapter 3 – Water Use. ABS Catalogue No. 4610.0.55.007 (p. 59 Table 3.7)

- ecosystems integrity and continuity;
- controlling pollutants loads;
- soils conservation; and
- bank stability.

An analysis of the main literature supporting policy development in the Basin attempted to identify impacts of minerals operations on these values. The findings are presented in Table 10.

Overwhelmingly, the literature reviewed indicates that there are not substantial impacts from mining operations on environmental values across the Murray-Darling Basin.

Table 10 Review of literature – impact of mining operations on environmental values of the Murray-Darling Basin

	Assessment of the impact of mining operations (literature summary)			
Publication	**Severe impact**	**Substantial impact**	**Minor impact**	**No impact/No mention**
Department of Environment, Water, Heritage and the Arts. State of the Environment 2006[29]		Significant consumption of energy 300PJ equivalent to residential uses Fig.4 p.12	Maintain population in rural towns p.9 2% of annual water consumption (401 GL). Table 14 p.60. Degradation of waterways downstream of some mining sites p.67	
Department of Environment, Water, Heritage and the Arts. State of the Environment 2001[30]		Disturbance to seabird populations and habitats p. 35 Possible collusion with areas of high biodiversity value. p.53	Airborne dust source p.30 Chemical weathering of the land. Table 9 p.46	
Great Artesian Basin Consultative Council. GAB Technical Study no.5 Environmental Issues (2006)				✓
Great Artesian Basin Consultative Council: GAB Strategic Management Plan (2000)	Significant proportion of Gross Value of Basin Production (p.	Groundwater use (p.29)		

[29] Beeton RJS (Bob), Buckley Kristal I, Jones Gary J, Morgan Denise, Reichelt Russell E, Trewin Denis (2006 Australian State of the Environment Committee) 2006, Australia State of the Environment 2006, Independent report to the Australian Government Minister for the Environment and Heritage, Department of the Environment and Heritage, Canberra.

[30] Australian State of the Environment Committee, 2001. Australia State of the Environment 2001, Independent Report to the Commonwealth Minister for the Environment and Heritage, CSIRO Publishing on behalf of the Department of the Environment and Heritage, Canberra.

Publication	Severe impact	Substantial impact	Minor impact	No impact/No mention
	30)			
Australian Conservation Foundation, Inland Rivers Network, WWF (2008). National Report for Ramsar wetlands for the Ramsar CoP October-November 2008				✓
Australian Conservation Foundation, Inland Rivers Network (undated). Vision for a Framework under the NWI for Protecting High Conservation Value Freshwater Areas in Australia.		Mining Operations to be restricted in high conservation value areas (p.9)		
Wentworth Group of Concerned Scientists and WWF (2002). Blueprint for a Living Continent.				✓
Wentworth Group of Concerned Scientists and WWF (2003). Blueprint for a National Water Plan.				✓
Murray Darling Basin Authority – Media Releases since Dec 15 2008.				✓
MDB Ministerial Council communiqués since Dec 15 2008				✓
Murray Darling Basin Committee. Sustainable Rivers Audit. A report on the ecological health of rivers in the Murray-Darling Basin, 2004–2007(2008)			Impact of historical gold mining on Buckland River and Reedy Creek. (p. 288)	
Murray-Darling Basin Ministerial Council (2008) 2007–08 Living Murray Environmental Watering Report				✓
Murray-Darling Basin Ministerial Council (2008) Murray-Darling Basin Risks Strategy				✓
Murray-Darling Basin Ministerial Council (2008).TLM Icon Site Condition Monitoring Report for 2008				✓
Murray Darling Basin Commission (2005). Groundwater Status Report 2000-05 - Management Report.				✓
Murray Darling Basin Commission (2008). Modern Agriculture Under Stress - Lessons from the Murray-Darling				✓
Murray Darling Basin Commission – Media Releases from January 2008 to November 2008				✓
CSIRO (2008). Water Availability in the Murray-Darling Basin Report				✓
CSIRO (2008). Murray region: CSIRO Murray-Darling Basin Sustainable Yields Project				✓
CSIRO (2008). Murrumbidgee region: CSIRO Murray-Darling Basin Sustainable Yields Project				✓
CSIRO (2008). Barwon-Darling region: CSIRO Murray-Darling Basin Sustainable Yields Project				✓

Assessment of the impact of mining operations (literature summary)

Publication	Severe impact	Substantial impact	Minor impact	No impact/No mention
CSIRO (2008). Condamine-Balonne region: CSIRO Murray-Darling Basin Sustainable Yields Project				✓
CSIRO (2008). Moonie region: CSIRO Murray-Darling Basin Sustainable Yields Project				✓
CSIRO (2008). Campaspe region: CSIRO Murray-Darling Basin Sustainable Yields Project			Habitat Loss (p.18)	
CSIRO (2008). Loddon-Avoca region: CSIRO Murray-Darling Basin Sustainable Yields Project			Habitat Loss (p.19)	
CSIRO (2008). Goulburn-Broken region: CSIRO Murray-Darling Basin Sustainable Yields Project				✓
CSIRO (2008). Macquarie-Castlereagh region: CSIRO Murray-Darling Basin Sustainable Yields Project				✓
CSIRO (2008). Lachlan region: CSIRO Murray-Darling Basin Sustainable Yields Project			Alteration of native vegetation (p. 17)	
CSIRO (2008). Ovens region: CSIRO Murray-Darling Basin Sustainable Yields Project				✓
CSIRO (2008). Gwydir region: CSIRO Murray-Darling Basin Sustainable Yields Project overview				✓
CSIRO (2008). Namoi region: CSIRO Murray-Darling Basin Sustainable Yields Project overview				✓
CSIRO (2008). Border Rivers: CSIRO Murray-Darling Basin Sustainable Yields Project overview				✓
CSIRO (2008). Paroo, CSIRO Murray-Darling Basin Sustainable Yields Project overview				✓
CSIRO (2008). Wimmera Region CSIRO Murray-Darling Basin Sustainable Yields Project overview				✓
CSIRO (2008). Eastern Mount Lofty Ranges, CSIRO Murray-Darling Basin Sustainable Yields Project overview				✓

5. LOCALISED IMPACTS AND THEIR MANAGEMENT

In each Murray-Darling Basin jurisdiction (except the ACT), localised impacts of minerals operations on environmental, social, and economic values of the site and region are assessed and managed. This assessment process occurs before development, typically considers alternative land use options, and determines the conditions under which development can proceed. A typical environmental impact assessment process includes:

- a detailed description of the existing and approved activities at the location, the current regulatory controls, the existing environmental management and monitoring regime and the likely staging of the approved (but undeveloped) operations at the mine;
- a detailed description of the project including:
    - the need for the project;
    - a detailed resource and land use assessment;
    - alternatives considered, including a justification for the project on economic, social and environmental grounds;
    - various components and stages of the project; and
    - the likely inter-relationship between the proposed operations and the existing or approved mining operations in the region;
- a risk assessment of the potential environmental impacts of the project, identifying the key issues for further assessment;
- a detailed assessment of the key issues specified below and any other significant issues identified in the risk assessment (see above), which includes:
    - a description of the existing environment, using sufficient baseline data;
    - an assessment of the potential impacts of all stages of the project, including any cumulative impacts, taking into consideration any relevant guidelines, policies, plans and statutory provisions;
    - a description of the measures that would be implemented to avoid, minimise, mitigate, rehabilitate/remediate, monitor and/or offset the potential impacts of the project, including detailed contingency plans for managing any potentially significant risks to the environment;
- a statement of commitments, outlining all the proposed environmental management, mitigation and monitoring measures; and
- a conclusion justifying the project on economic, social and environmental grounds.

Key issues for detailed consideration are typically determined on a project-by-project basis, through consultation with government and non-government stakeholders. However it is not unusual for the environmental impact assessment process to include detailed assessment of the following key issues:

- soil and water – including:
    - a detailed local and regional groundwater model;
    - a detailed site water balance;
    - potential loss of surface and groundwater water flows to the environment and other land users;
    - potential water quality impacts on the environment and other land users, including salinity impacts; and
    - a description of final void water management;
- biodiversity – including:
    - accurate estimates of any vegetation disturbance associated with the project;

  - impacts on other threatened species, populations or ecological communities; critical habitats (including riparian habitat); and native vegetation generally;
  - a detailed description of the measures that would be implemented to maintain or improve the biodiversity values of the project area and surrounding region in the medium to long term;
- heritage – both Aboriginal and non-Aboriginal;
- noise and blasting – including construction, operational and road traffic noise;
- subsidence – including;
  - predictions of the potential subsidence effects of the proposed mine plan, and detailed sensitivity analysis of these predictions; and
  - a detailed assessment of the potential impacts of these subsidence effects on both the natural and built environment, paying particular attention to significant features of this environment;
- air quality;
- energy – calculate the scope 1 and 2 emissions of the mining operations and describe what measures would be implemented to ensure these operations are energy efficient;
- traffic and Transport;
- waste – including:
  - accurate estimates of the quantity and nature of the potential waste streams of the project;
  - a detailed description of the measures that would be implemented to minimise, reuse, recycle and dispose of any waste produced on site, including tailings and waste rock;
- visual and amenity;
- rehabilitation and final landform – including:
  - how the site would be progressively rehabilitated and integrated into the landscape, taking into account the rehabilitation plans of existing and approved mining operations in the vicinity; and
  - what measures would be put in place for the long term protection and management of the site following cessation of mining taking into consideration any relevant strategic land use planning or resource management plans or policies; and
- socio-economic benefits and impacts at local and regional scales.

A range of statutory requirements apply in each jurisdiction to different stages of the mining cycle, from approval through to post-closure. Following the impact assessment process, the approval conditions set the conditions under which the development can proceed, and annual regulatory reports, audited by third parties where appropriate, are provided to relevant agencies, to report against compliance with approval conditions. These requirements are formalised through regulatory requirements in each jurisdiction. Despite COAG commitments to reduce regulatory burdens and inefficiencies, a plethora of Australian federal and state government layers of legislation and regulation remain, which control the access of minerals operations to land and water resources, and impacts associated with those operations in the Murray-Darling Basin (Table 11). See Figure 5 for an example of how the various pieces of legislation interact to control minerals industry access to water resources.

Table 11 Existing legislation controlling access to land and water resources by minerals operations within the Murray-Darling Basin (SKM 2009)

Jurisdiction	Legislation
Commonwealth	Environment Protection and Biodiversity Conservation Act 1999
	Commonwealth Water Act 2007
	Commonwealth Water Regulations 2008
Queensland	State Development and Public Works Organisation Act 1971 (SDPWO Act) (for 'significant projects')
	Integrated Planning Act 1997 (not applicable to mining environmental assessment)
	Environmental Protection Act (EP Act) 1994 (relevant to mining activities)
	Water Act 2000
	Mineral Resources Act 1989
	Mineral Resources Regulation 2003
	Nature Conservation Act 1992
	Vegetation Management Act 1999
	Vegetation Management Regulation 2000
New South Wales	Environmental Planning and Assessment Act 1979
	Environmental Planning and Assessment Regulation 2000
	Water Management Act 2000
	Water Act 1912
	Mine Health and Safety Act 2004 No 74
	Mine Safety (Cost Recovery) Act 2005 No 116
	Mine Subsidence Compensation Act 1961 No 22
	Mining Act 1992 No 29
	Mining Amendment Act 2008 No 19
	Threatened Species and Conservation Act 1995
	Native Vegetation Act 2003 No 103
Victoria	Mineral Resources (Sustainable Development) Act 1990
	Environment Effects Act 1978
	Planning and Environment Act 1987
	Water Act 1989
	Mineral Resources Development Act 1990
	Mineral Resources (Sustainable Development) Act 1990
	Murray-Darling Basin Act 1993
	Mines Act 1958
	Conservation, Forests and Lands Act 1987
	Environment Protection Act 1970
South Australia	Mining Act 1971 (Mining and Rehabilitation Management Plan) process for standard projects
	Development Act 1993 (EIS process) for projects of major social, economic or environmental significance
	Natural Resources Management Act 2004
	Murray-Darling Basin Act 2008
	Environment Protection Act 1993

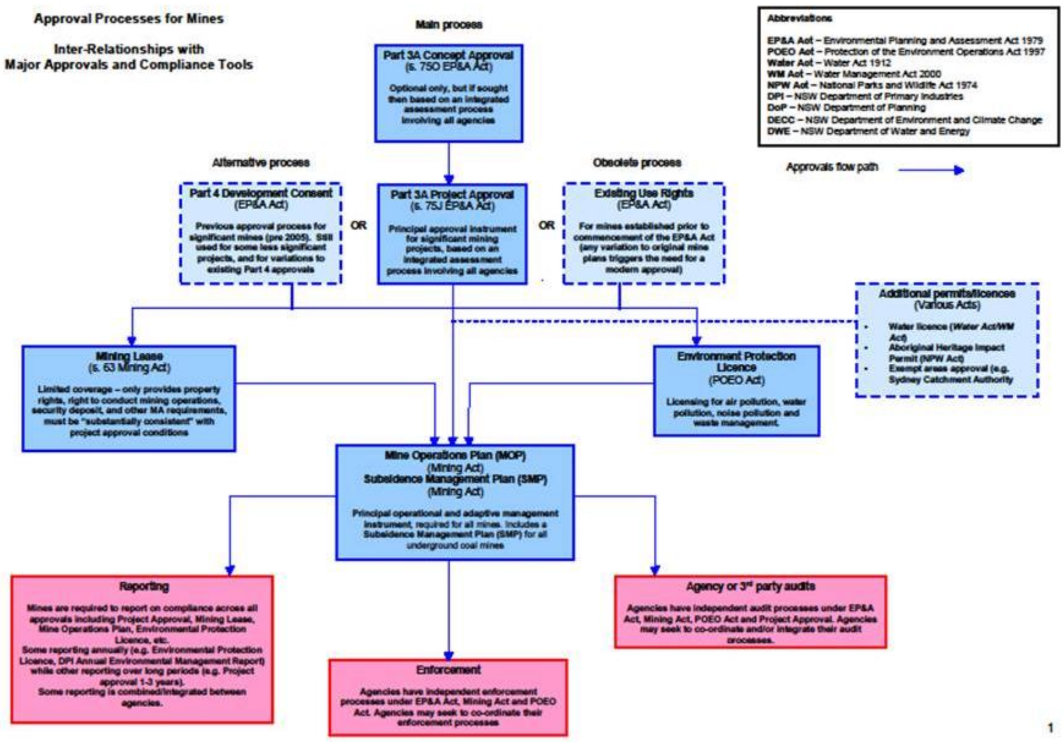

Figure 5 Legislative requirements for development and ongoing management of minerals operations in NSW

6. ON AGRICULTURAL PRODUCTIVITY AND THE RELATIVE IMPORTANCE OF MINERALS OPERATIONS

Mining is not typically regarded as a threat to food security, or specifically, agricultural production. It is difficult to find empirical evidence that suggests otherwise. For example, mining or minerals extraction is not implicated in influencing agricultural productivity or food security in:

- Productivity Commission (2005) Trends in Australian Agriculture, Canberra;
- Koning and van Ittersum (2009) Will the world have enough to eat? Current Opinion in Environmental Sustainability 1: 77-82;
- Koning et al (2008) Long-term global availability of food: continued abundance or new scarcity? Wageningen Journal of Life Sciences 55: 229-292; and
- Norse (1994) Multiple threats to regional food production: environment, economy, population? Food Policy 19: 133-148.

Where there are concerns regarding changing land use availability for agricultural production, they are primarily related to impacts from declining capability within agricultural uses (Norse 1994); pressures to convert food production to 'renewable energy' production (Koning and van Ittersum 2009); and urban encroachment in densely populated catchments (Koning *et al* 2008). These broad patterns are reflected on-ground in the Murray-Darling Basin. Impacts on agricultural production via competition for land and water resources, are far greater from:

1. broad scale dryland salinity,
2. environmental water 'buybacks'; and
3. urban expansion;

than are likely to be experienced from minerals operations under any foreseeable development scenarios (e.g. a doubling of minerals production by 2020, modelled under the MCA's Vision 2020 project[31]).

6.1 Dryland salinity

Dryland salinity is one the critical threats currently faced by the MDB. Dryland salinity poses many natural resource management problems, including:

- soil degradation;
- loss of agricultural productivity;
- loss of biodiversity especially in low lying areas (wetlands, Murray anabranches, marshes);
- water quality degradation (increased salinity sometimes beyond WHO drinking water standards);
- impacts on infrastructure; and
- economic impacts.

The dryland salinity issues are particularly of concern in the wheat belt and south-west of Australia and the Murray-Darling Basin (Figure 6)

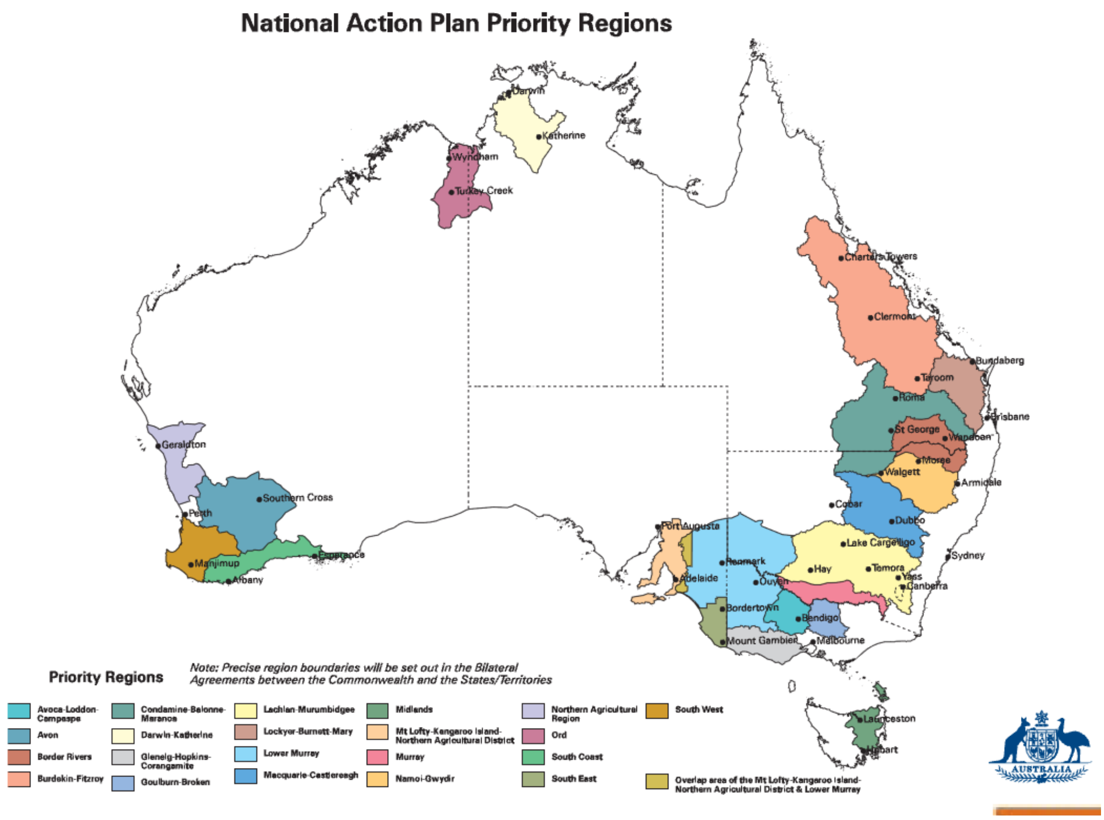

Figure 6 National Action Plan for Salinity – priority areas (DAFF, 2002[32])

The most comprehensive attempt to provide an overview of the (dryland) salinity threat across Australia was undertaken as part of the National Land and Water Resources Audit in 2000 (Australian Senate, March 2006[33]). Individual salinity

[31] http://www.minerals.org.au/mca_2020_vision/index.html
[32] DAFF (2002) National Action Plan for Salinity and Water Quality – Fact Sheet (available from URL: http://www.daffa.gov.au/__data/assets/pdf_file/0010/29098/salinity-factsheet.pdf last accessed 01/09/2009)
[33] The Senate of Australia. Environment, Communications, Information Technology and the Arts References Committee (March 2006). The extent and economic impact of salinity in Australia. p.10 & 11 of 278. Document available on the Internet from http://www.aph.gov.au/Senate/committee/ecita_ctte/completed_inquiries/2004-07/salinity/report/report.pdf last accessed 04/09/2009.

assessments were conducted by six states (New South Wales, Victoria, Queensland, South Australia, Western Australia and Tasmania), which were then collated into one report, the *Australian Dryland Salinity Assessment 2000*.

In this report, the National Land and Water Resources Audit Advisory Council reported that approximately 5.7 million hectares of Australia's agricultural and pastoral zone are in regions at risk of developing dryland salinity, particularly in areas with shallow aquifers. Predictions based on groundwater trends, field surveys and landscape characteristics indicated that unless effective solutions are implemented, the "at risk" area could increase to 17 million hectares by 2050 (170 000 km^2). Most is agricultural land (more than 11 million hectares; 110 000 km^2). The best available estimate of the minerals industry's footprint in the Basin is 2 800 km^2, or 2.5% of the agricultural land at risk of being affected by dryland salinity.

Table 12 Areas (ha) with high potential to develop dryland salinity in Australia (NLWRA, 2001[34])

State/Territory	1998/2000	2050
New South Wales	181 000	1 300 000
Victoria	670 000	3 110 000
Queensland	n/a	3 100 000
South Australia	390 000	600 000
Western Australia	4 363 000	8 800 000
Tasmania	54 000	90 000
Total	**5 658 000**	**17 000 000**

Note: The Northern Territory and ACT were not included as the dryland salinity problem was considered to be very minor.

6.2 Water transfers and Australian Government water buy-back

The Living Murray Program was established in 2002 in response to evidence showing the declining health of the River Murray system. It is a partnership of the Australian, NSW, Victorian, South Australian and ACT governments. The program's 'first step' started in 2004, and finishes in 2009. It focuses on recovering 500 GL of water for the River Murray specifically for the benefit of plants, animals and the millions of Australians it supports, along with improving the environment at six icon sites.

The MDBA announced in June 2009 that it had recovered the 500 GL needed for the protection of environmental values (**Error! Reference source not found.** 13). The estimated 20 GL of minerals industry's water use in the Basin equates to 4% of the volume of water returned to protect environmental values.

[34] National Land and Water Resources Audit Advisory Council (2001). Australian Dryland Salinity Assessment 2000. Table 1, p. 3 of 10,

Table 13 Water recovery in the Living Murray (MDBA, June 2009[35])

State / Territory	Projects in development	Being implemented	Recovered water	Recovery Target
NSW	0	34.11 - 46.11	176.1	249
VIC	0	82	120	214
SA	0	2	33	35
ACT	0	0	0	2
AUS GOV'T	0	0	0.18	None
MDBA	0	23.07–33.07	13.2	None
Total	**0**	**141.2-163.2**	**342.5**	**500**

6.3 Expansion of regional towns

The population in the MDB is increasing.

The increasing population places greater demand on local water supplies and the development of urban and residential areas. Table provides an overview of the population changes occurring in the major urban centres in the Murray Darling Basin showing a population increase in excess of 10% for the period 1996-2006.

Table 14 Population change, major urban centres in the Murray-Darling Basin (ABS, 2008[36])

	State/territory	Population	Change
		2006	1996–2006
		no.	*%*
Canberra-Queanbeyan	NSW/ACT	356 120	11.1
Toowoomba	Qld	84 850	13.1
Bendigo	Vic.	76 050	27.1
Albury-Wodonga	NSW/Vic.	73 500	9.4
Wagga-Wagga	NSW	46 740	9.3
Shepparton-Morroopna	Vic.	38 770	21.6
Tamworth	NSW	33 480	5.3
Orange	NSW	31 550	2.9
Dubbo	NSW	30 570	1.7
Mildura	Vic.	30 020	24.6
Bathurst	NSW	28 990	11.7

[35] Murray Darling Basin Authority (2009). The Living Murray. Environmental Water Recovery Progress Report. p.2. Document available on the Internet from: http://www.mdba.gov.au/system/files/TLM-WR-prog-rep-JUN09.pdf last accessed 08/09/2009.

[36] ABS (August 2008). Water and the Murray-Darling Basin - A Statistical Profile, 2000-01 to 2005-06. Chapter 2 – People in the Murray Darling Basin. ABS Catalogue No. 4610.0.55.007 (p. 28 Table 2.6). Available on the Internet from http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/E2873D87308208BDCA2574A50015681D/$File/4610055007_2000-01%20to%202005-06_ch2.pdf last accessed 03/09/2009.

6.4 Summary of Negative Impacts on Agricultural Productivity in the Murray-Darling Basin

Considering that current minerals operations use *circa* 20 GL of water annually in the Murray-Darling Basin, and have a footprint of 2 800 km^2, even a doubling of minerals operations in the Basin would have a negligible impact on agricultural production at the Basin-scale. In the context of other current effectors of agricultural productivity in the Basin, namely dryland salinity, environmental water buybacks, and urban expansion, minerals operations' localised impacts have barely been mentioned by scientists and policy makers charged with resolving the natural resource management challenges of the Murray-Darling Basin.

This outcome is due to a variety of factors, including: (1) the low relative importance of minerals operations to the drivers of natural capital decline in the Basin; (2) the current existing regulatory frameworks within which environmental impacts are managed; and (3) the leadership operations have taken in developing and applying environmental stewardship frameworks (e.g. *Enduring Value*).

6.5 Opportunities that Mining Brings to the Murray-Darling Basin

The minerals industry brings potential benefits to regional communities and the Murray-Darling Basin more broadly, including, amongst others:

- diversification of regional economies (including the opportunity for holders of water entitlements to sell temporary allocations to high-value users);
- thickening of water markets, enabling water to flow to its highest value use (see the NWC's most recent Water Markets Report, where average prices for water were highest in the Hunter Valley);
- benefit sharing with, and economic opportunities for, Indigenous Community Stakeholders (e.g. the Wiradjuri Condobolin Corporation);
- enhanced knowledge and capacity building around natural resource management37 (see the Lake Cowal Foundation, and Agricultural Research undertaken at the Northparkes Mine for two examples); and
- opportunities to support structured and planned land use change to bring development opportunities back into alignment with natural resources capability.

6.6 Resolving High-profile Land Use Conflicts

If these benefits are to be realised, and the current values of the Basin are to be protected, an integrated land use planning program is required. Current land use conflicts, despite their public profile, are not issues of national or regional importance with respect to agricultural productivity. These are local issues that can be resolved locally.

Structured and integrated land use planning initiatives can help resolve these tensions, by having open and transparent discussions around land use values and opportunities, understanding all stakeholders' perspectives, and fostering an understanding of the conditions under which development can occur.

'Land use planning' describes the full suite of activities of all stakeholders involved in making societal decisions about the use of the landscape. 'Uses' include a variety of activities undertaken to sustain human populations, including 'biodiversity conservation', 'agricultural production', 'water production', and 'minerals production' (amongst others) which can overlap in space and time.

In regional and remote Australia, minerals operations, both ongoing and developing, present both risks and opportunities for regional communities. Despite generating considerable wealth for the nation from agricultural and minerals production,

[37] The *2001 State of Environment* report highlights[37]:
"*The mining industry, for example, employs biologists to study and evaluate biological values in many parts of Australia, for the purpose of codes and environmental impact assessments associated with proposed developments. Previously only biologists from government departments and academic institutions collected the regional biological datasets."* (pp. 71-72)
"*Mining has developed these planning issues through capitalising on the need to undertake an environmental impact assessment of proposed developments. Particularly for larger proposed developments, the background data collected on geology, landforms, soils, hydrology, flora, vegetation and fauna have allowed a high degree of sophistication to enable the interpretation of potential direct and indirect effects*." (pp. 80-81)

regional and remote areas do not receive a commensurate level of attention and investment in landscape and land use planning. Additionally, land use planning responsibilities are typically fragmented across different government portfolio areas responsible for community services, water resource planning, biodiversity conservation, infrastructure provision, and environmental protection. Further, under Australia's Federal system of governance, these responsibilities are divided or duplicated across layers of governance.

For example, currently in Australia, land use planning associated with biodiversity conservation transcends:

- local government (e.g. statutory 'local environment plans', particularly at the rural – urban interface);
- State government agencies (e.g. conservation agencies – 'biodiversity strategies', water planning authorities – 'statutory water plans' with provision for environmental flows);
- regional NRM organisations (e.g. 'catchment action plans ' with biodiversity targets); and
- Commonwealth, State and local government development approval processes (e.g. which assess and manage project-specific impacts on biodiversity).

Similar hierarchies can be outlined for other landscape elements, and there are few examples of coordination and strategic management across portfolio areas.

The MCA considers that these traditionally duplicative, part overlapping, and often conflicting land use planning processes can result in considerable land use conflicts or inefficiencies, including:

- wasted resources in duplicated planning processes, and as noted in Seymour et al. (2007), burn-out of heavily engaged stakeholders;
- a misalignment of 'optimal land capability' and its subsequent 'uses';
- a misalignment of the pace of planning and different stakeholder requirements;
- lack of collation, integration and use of data collected by landscape stakeholders;
- potential limitations on future land uses based on short term decisions;
- a lack of understanding amongst stakeholders regarding land use planning, resource access arrangements, and future land use potential;
- stakeholders 'falling through the gaps' and perceiving a lack of engagement and influence in the decision making process;
- perverse interactions between market based instruments and existing regulatory arrangements;
- ad-hoc, reactionary and public resource access conflicts;
- cumulative impacts of major proposals not being well assessed (across spatial and temporal scales) and impacts of long-term land management activities not being factored into subsequent impact analyses; and
- a fragmented approach to stakeholder engagement, resulting in stakeholders being unaware of the implications of some land use planning decisions on their future social and economic opportunities.

The MCA supports the development of a truly regional natural resource planning model to include:

- the most efficient allocation of limited NRM investments in the landscape;
- more efficient planning and stakeholder engagement processes (including data acquisition and analysis, reduced stakeholder burn-out);
- clear demarcations between government, industry and other stakeholder responsibilities in land use planning;
- clear timetables for land use planning activities, based on anticipated resource demand scenarios;
- reduced risks related to over allocation of scarce resources, including land and water resources, to inefficient uses;

- better consideration and strategic alignment of systemic cumulative impacts, positive and negative, from all landscape activities;
- increased capacity to respond to changes in resource availability through climate change; and
- reduced likelihood of land use planning conflicts, since all stakeholders can be involved in a long-term strategic land use planning process.

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